

1 **WHAT IS CLAIMED IS:**

2 1. A functional printed circuit board (PCB) module having an embedded
3 chip, the PCB module comprising:

4 a frame having two opposite sides and at least one chip recess defined in
5 the frame;

6 a first printed circuit formed on one side of the frame and insulated from
7 the frame;

8 at least one chip mounted in the at least one chip recess and connected to
9 the first printed circuit, wherein the at least one chip has a top face, a bottom face
10 and multiple terminals each of which is formed on the top face and connected to
11 the first printed circuit; and

12 insulation material filling the at least one chip recess.

13 2. The functional PCB module as claimed in claim 1, wherein the frame
14 is nonmetallic.

15 3. The functional PCB module as claimed in claim 1, wherein the frame
16 is metal and further comprises a first insulation layer between the first printed
17 circuit and the frame.

18 4. The functional PCB module as claimed in claim 3, wherein the first
19 insulation layer has multiple through holes corresponding to the terminals
20 defined through the first insulation layer and the insulation material in the at least
21 one chip recesses; and

22 multiple plugs are formed respectively in corresponding through holes
23 to connect the first printed circuit to the at least one chip.

24 5. The functional PCB module as claimed in claim 4 further comprising:

1 a second insulation layer formed on the other side of the frame;
2 a second printed circuit layer formed on the second insulation layer; and
3 multiple vias each of which has an outside and is formed through the
4 first printed circuit, the first insulation layer, the frame, the second insulation
5 layer and the second printed circuit to connect the first printed circuit to the
6 second printed circuit.

7 6. The functional PCB module as claimed in claim 5, wherein an
8 insulation well is formed around the outside of each via between the first
9 insulation layer and the second insulation layer to insulate the via from the
10 frame.

11 7. The functional PCB module as claimed in claim 3 further comprising:
12 a second insulation layer formed on the other side of the frame;
13 a second printed circuit layer formed on the second insulation layer; and
14 multiple vias each of which has an outside and is formed through the
15 first printed circuit, the first insulation layer, the frame, the second insulation
16 layer and the second printed circuit to connect the first printed circuit to the
17 second printed circuit.

18 8. The functional PCB module as claimed in claim 7, wherein each chip
19 has multiple solder bumps formed respectively on the terminals, and the solder
20 bumps are connected to the second printed circuit.

21 9. The functional PCB module as claimed in claim 7, wherein the bottom
22 face of each chip is attached to the second printed circuit, and the terminals of
23 each chip are connected to the second printed circuit by wire bindings.

24 10. The functional PCB module as claimed in claim 2 further

1 comprising:

2 a second printed circuit layer formed on the second insulation layer; and
3 multiple vias each of which has an outside and is formed through the
4 first printed circuit, the frame and the second printed circuit to connect the first
5 printed circuit to the second printed circuit.

6 11. The functional PCB module as claimed in claim 10, wherein an
7 insulation well is formed around the outside of each via corresponding to the
8 frame to insulate the via from the frame.

9 12. The functional PCB module as claimed in claim 11, wherein each
10 chip has multiple solder bumps formed respectively on the terminals, and the
11 solder bumps are connected to the second printed circuit.

12 13. The functional PCB module as claimed in claim 11, wherein the
13 bottom face of each chip is mounted on the second printed circuit and the
14 terminals of each chip are connected to the second printed circuit by wire
15 binding.

16 14. A multi-layer functional PCB having embedded chips, combining at
17 least two functional PCB modules and a separation layer between adjacent
18 functional PCB modules, each functional PCB module comprising:

19 a frame having two opposite sides and at least one chip recess defined in
20 the frame;

21 a first printed circuit formed on one of two opposite sides and insulated
22 from the frame;

23 at least one chip mounted in the at least one chip recess and connected to
24 the first printed circuit, wherein the at least one chip has a top face, a bottom face

1 and multiple terminals formed on the top face and connected to the first printed
2 circuit; and

3 insulation material filling the at least one chip recess.

4 15. The multi-layer functional PCB as claimed in claim 14, wherein
5 each functional PCB module further comprises a second printed circuit formed
6 on the other side of the frame and insulated from the frame; and

7 the multi-layer functional PCB further comprises multiple vias, each of
8 which has an outside and is formed through adjacent functional PCB modules
9 and the separation layers to connect the first and second printed circuits on the
10 functional PCB modules.

11 16 The multi-layer functional PCB as claimed in claim 15, wherein the
12 frames in the functional PCB modules are metal and each functional PCB
13 module further comprises:

14 a first insulation layer between the first printed circuit and the frame; and

15 a second insulation layer between the second printed circuit and the
16 frame.

17 17. The multi-layer functional PCB as claimed in claim 16, wherein one
18 functional PCB module further comprises multiple through holes corresponding
19 to the terminals, wherein the multiple through holes are defined through the first
20 insulation layers and a plug mounted in each through hole.

21 18. The multi-layer functional PCB as claimed in claim 16, wherein each
22 chip of one functional PCB module has solder bumps formed respectively on the
23 terminals to connect the terminals to the second printed circuit.

24 19. The multi-layer functional PCB as claimed in claim 16, wherein the

1 bottom face of each chip of one functional PCB module is mounted on the
2 second printed circuit, and the terminals are connected to the second printed
3 circuit by wire bindings.

4 20. The multi-layer functional PCB as claimed in claim 18, wherein the
5 bottom face of each chip of another functional PCB module is mounted on the
6 second printed circuit, and the terminals are connected to the second printed
7 circuit by wire bindings.